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Micko et al.

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(54) **DUAL FIXED ANGLE SECURITY MOUNT**

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(51) **Int. Cl.**

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H05K 5/02	(2006.01)
F16B 1/00	(2006.01)
F16M 13/02	(2006.01)
H01F 7/02	(2006.01)

(52) **U.S. Cl.**

CPC ***H05K 5/0217*** (2013.01); ***F16B 1/00*** (2013.01); ***F16M 13/022*** (2013.01); ***F16M 13/025*** (2013.01); ***H01F 7/0252*** (2013.01); *F16B 2001/0035* (2013.01); *Y10T 29/49782* (2015.01); *Y10T 29/49948* (2015.01)

(58) **Field of Classification Search**

CPC .. H05K 3/301; Y10T 29/49826; Y10T 24/32; Y10T 29/49126; A63H 17/264; F16M 11/14; F16M 13/022; G01D 11/245; G01J 5/04; G01J 5/0843; Y10S 403/01; G01S 7/4813

USPC 361/807, 809, 810

See application file for complete search history.

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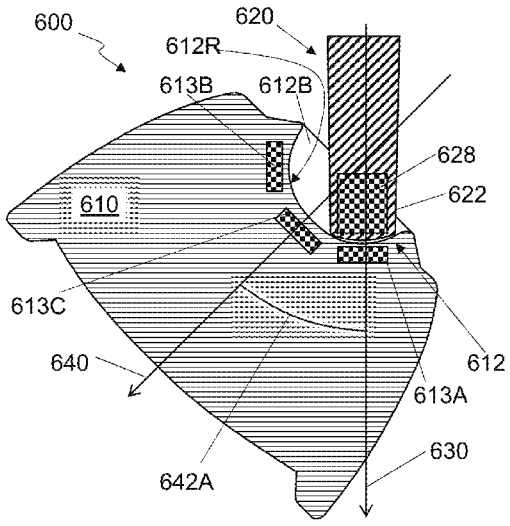
(57) **ABSTRACT**

A security apparatus includes a mount and a sensor body with a socket recessed into the sensor body at a first angle from a functionality plane. The mount includes a stem and a base adapted to be affixed to a wall. The stem extends from the base at a second angle from horizontal. The functionality plane is set at an angle from horizontal equal to the first angle plus the second angle if the stem is inserted into the socket with the first side of the stem in close proximity to the first wall of the socket, and the functionality plane of the sensor body is set at an angle from horizontal equal to the first angle minus the second angle if the stem is inserted into the socket with the first side of the stem in close proximity to the second wall of the socket.

26 Claims, 12 Drawing Sheets



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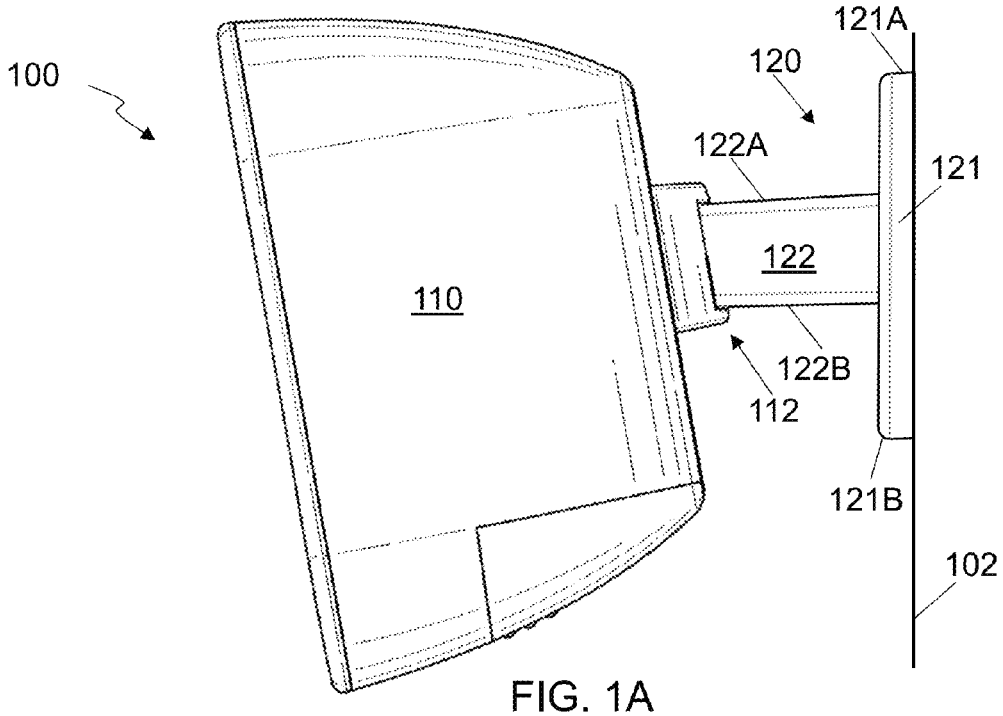

100
110
120
121A
121
122A
122
122B
112
121B
102

FIG. 1A

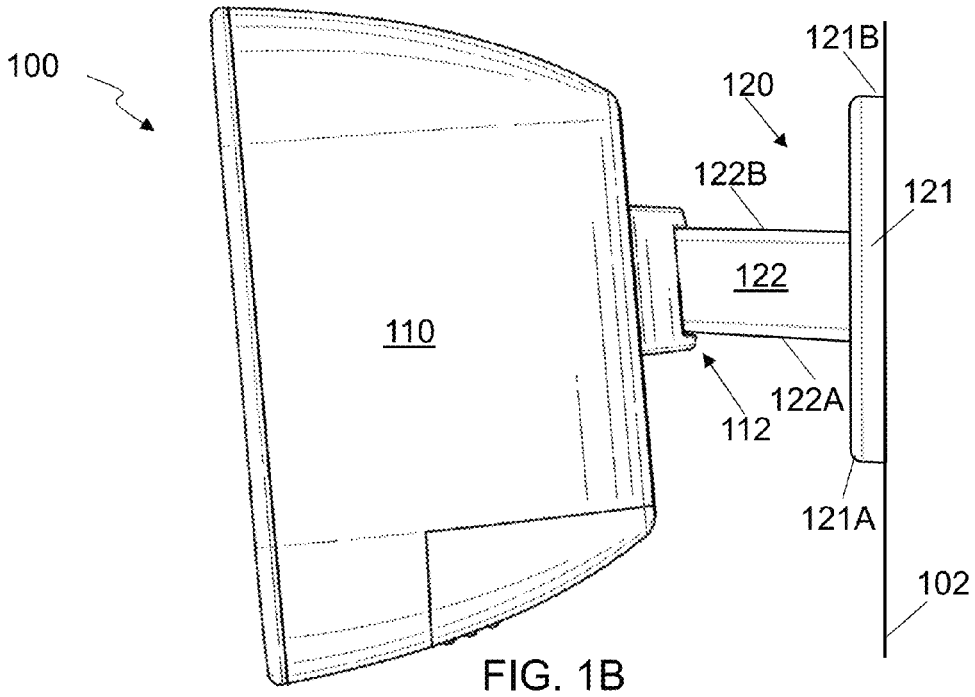
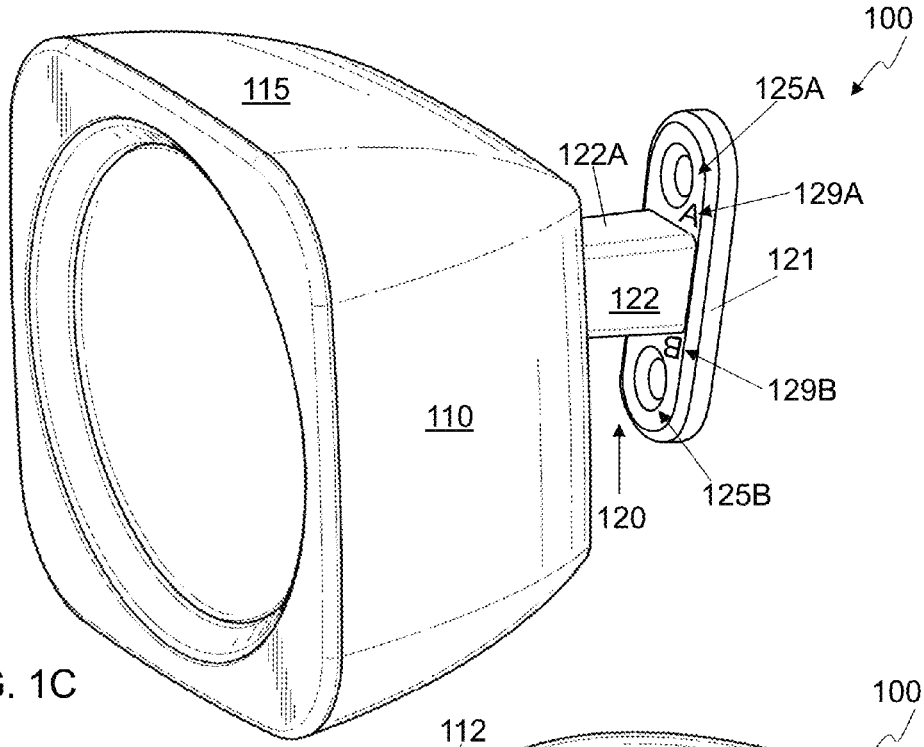

100
110
120
121B
121
122B
122
112
122A
121A
102

FIG. 1B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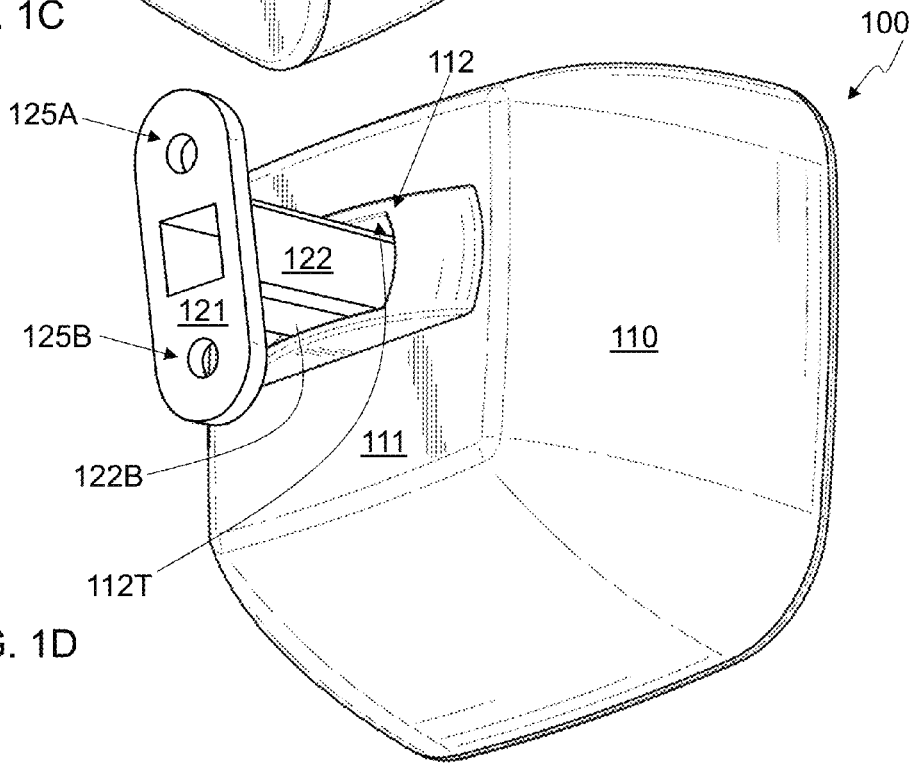
115
125A
122A
129A
A
121
122
B
129B
110
125B
120

FIG. 1C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112
125A
122
121
125B
110
111
122B
112T

FIG. 1D

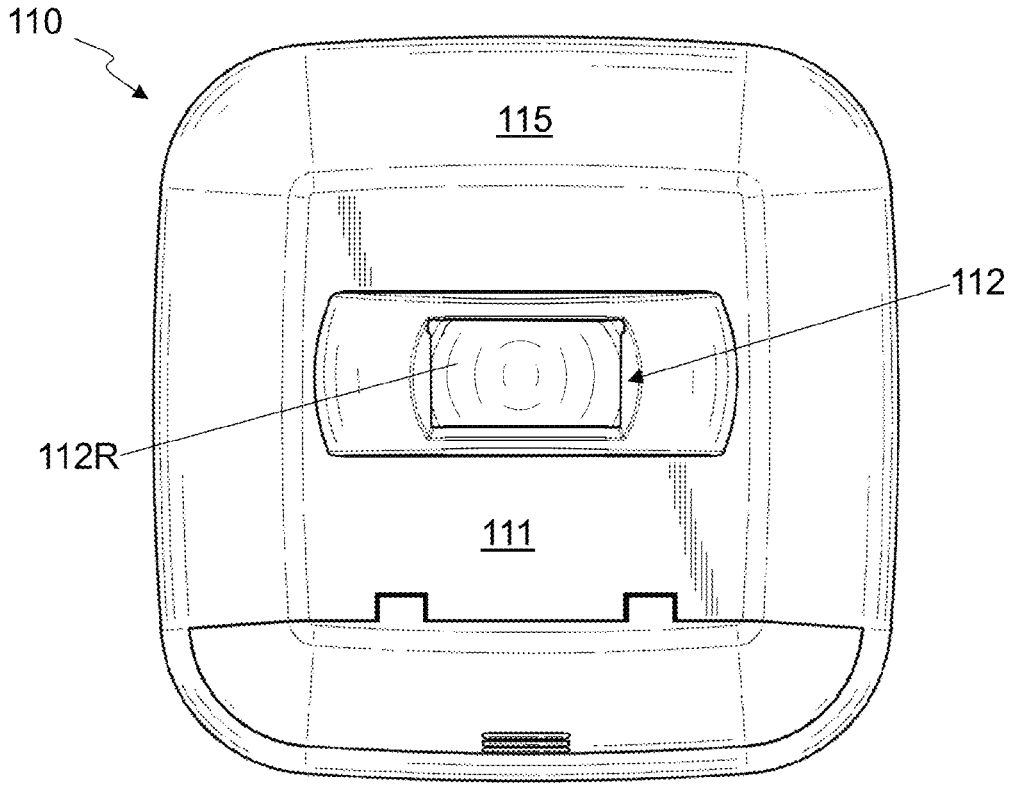


FIG. 1E

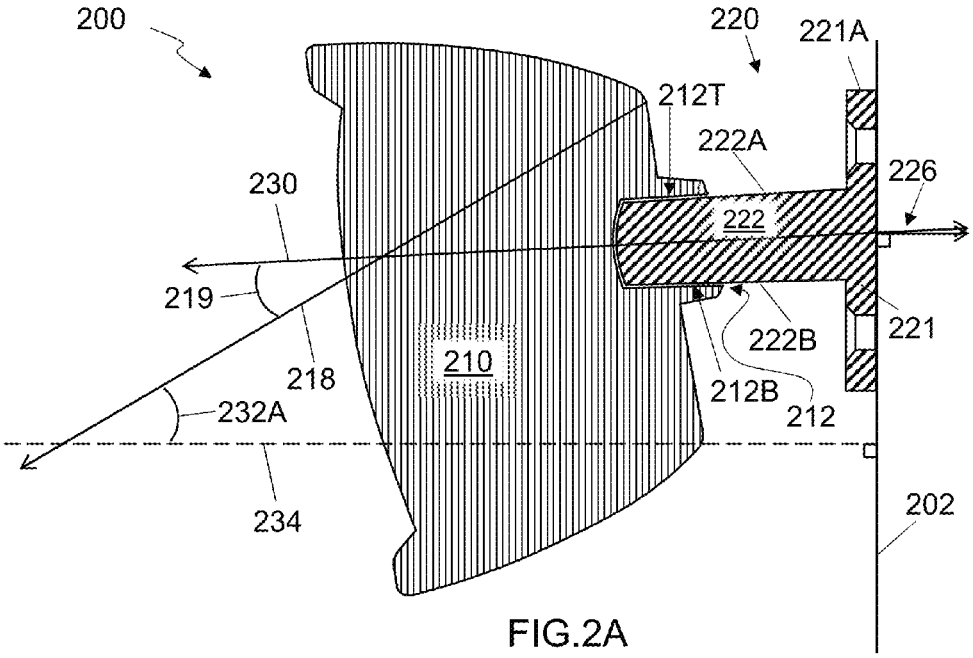

200
220
221A
212T
222A
226
230
222
219
221
222B
218
210
212B
212
232A
234
202

FIG.2A

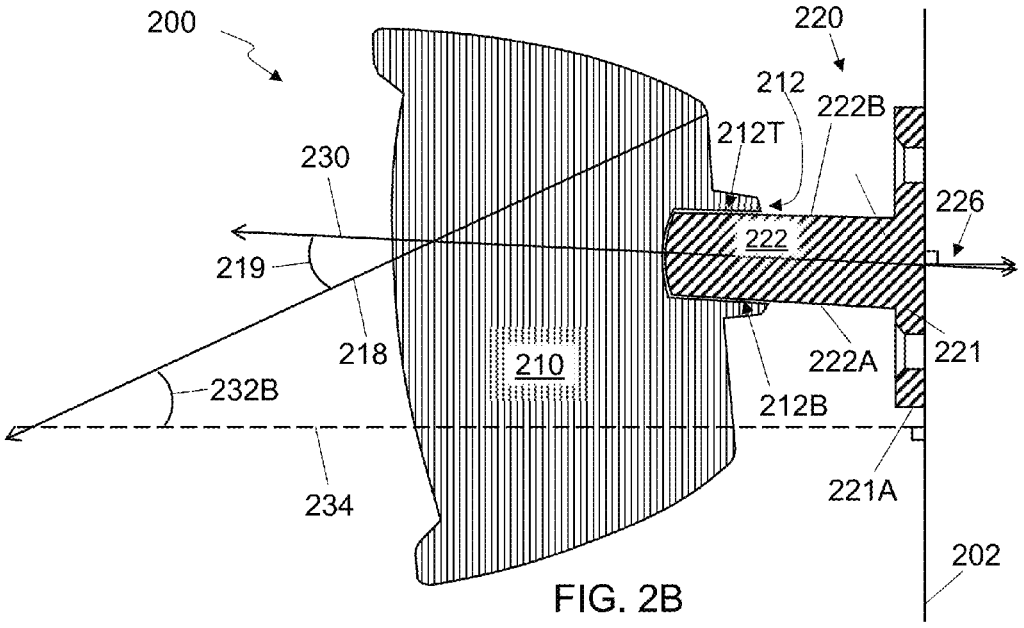

200
220
212
222B
212T
230
226
222
219
218
210
222A
221
232B
212B
234
221A
202

FIG. 2B

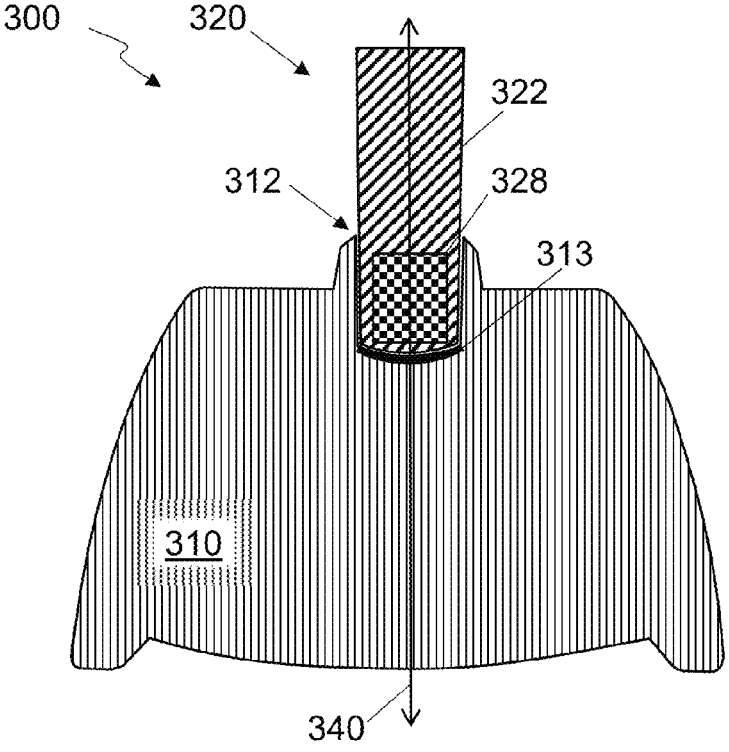


FIG. 3

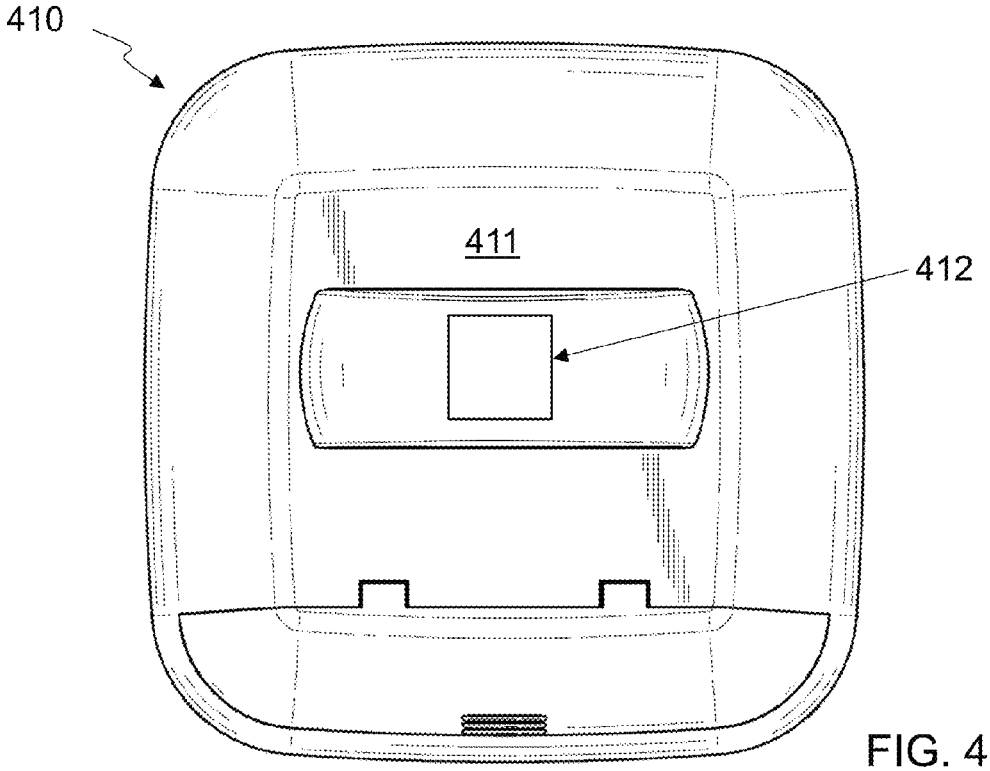


FIG. 4

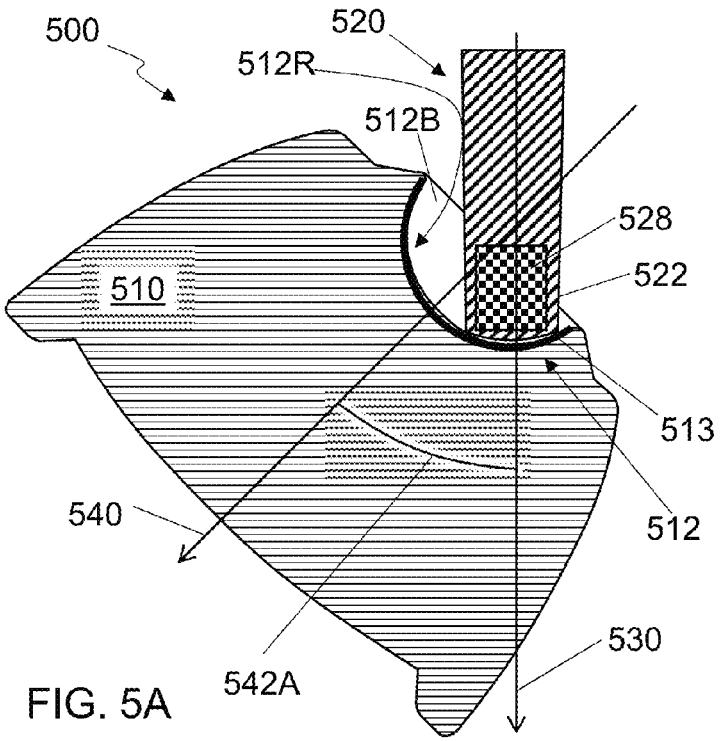
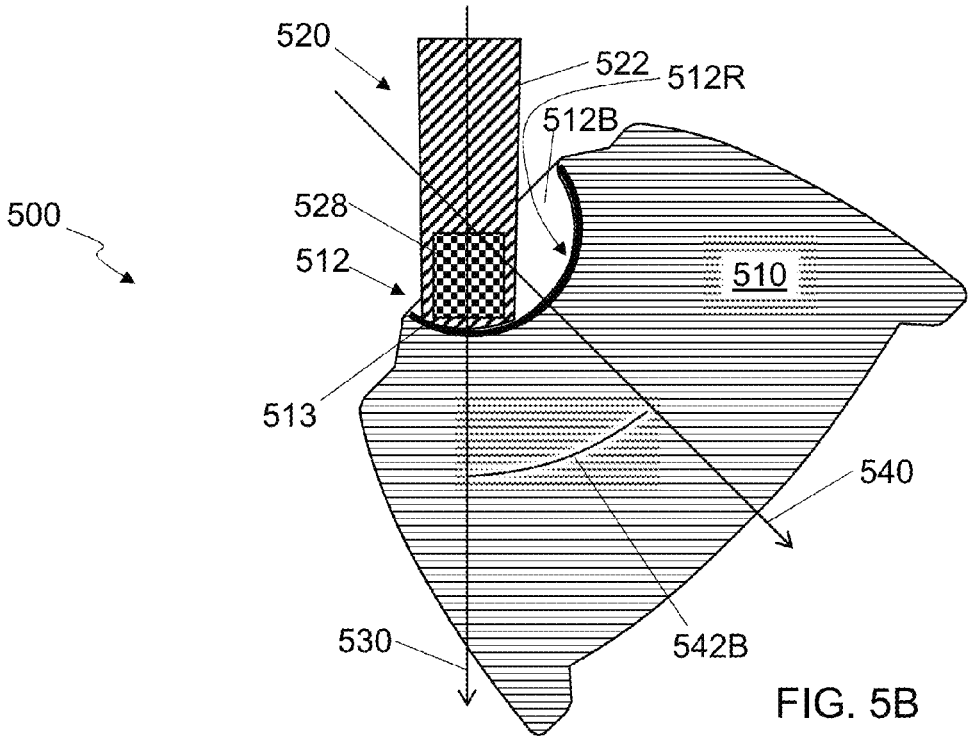

500
520
512R
512B
528
522
510
513
512
540
530
542A

FIG. 5A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522
512R
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528
512
510
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540
530
542B

FIG. 5B

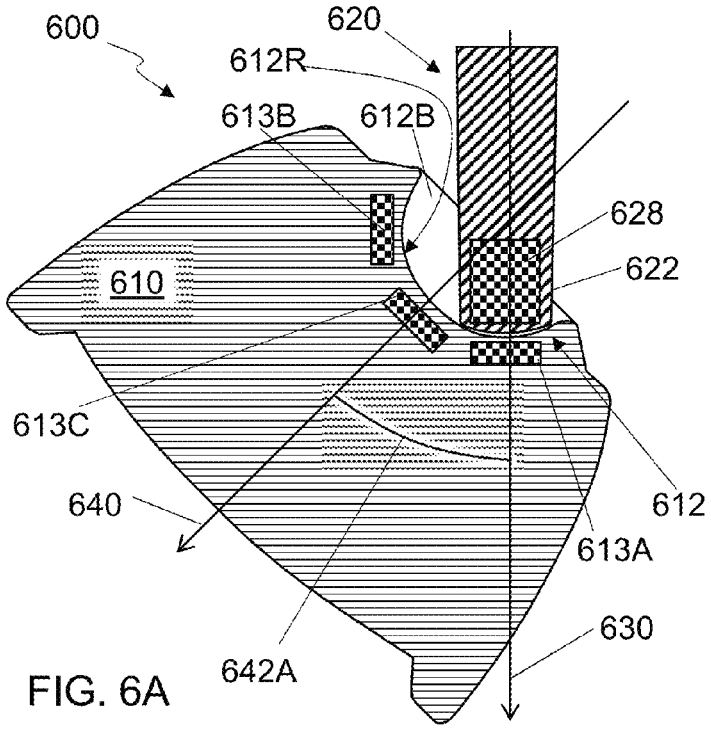
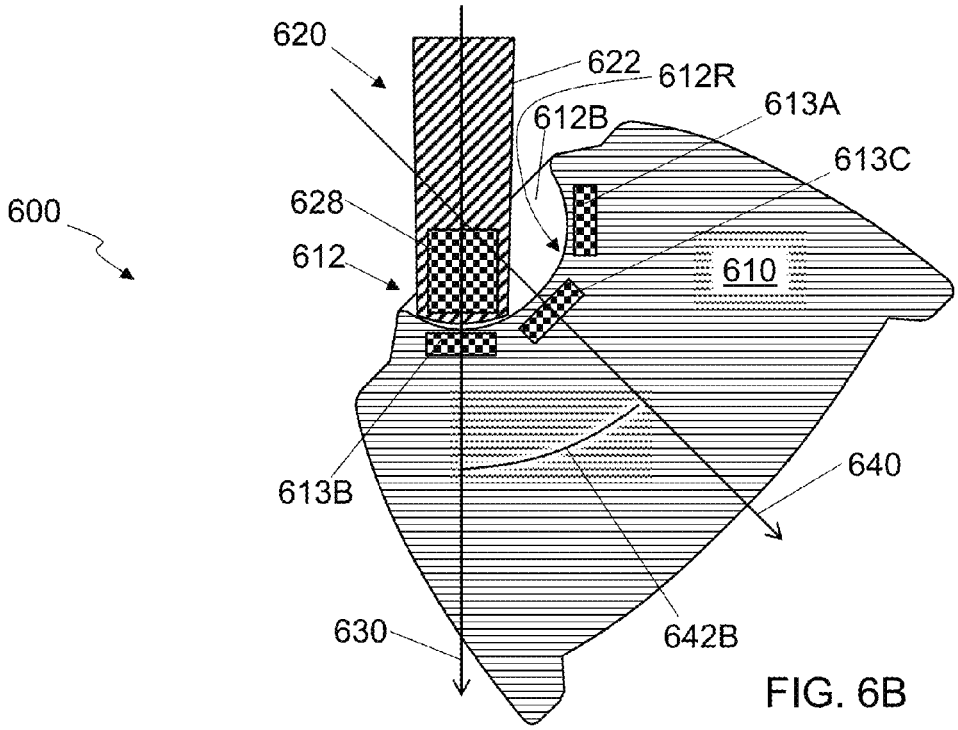

600
620
612R
613B
612B
628
622
610
613C
640
612
613A
630
642A

FIG. 6A


620
622
612R
613A
612B
613C
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628
612
610
640
613B
630
642B

FIG. 6B

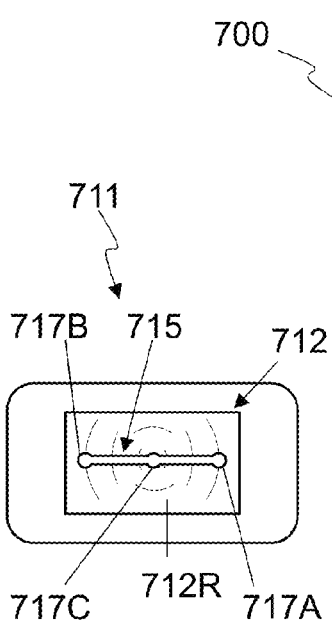
711
717B
715
712
717C
712R
717A

FIG. 7B

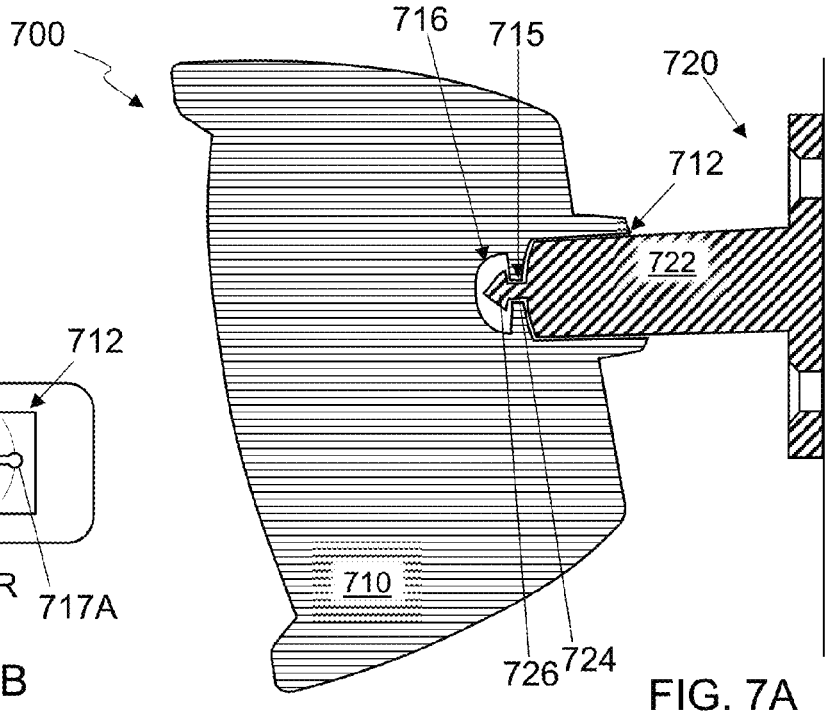
700
716
715
720
712
722
710
726
724

FIG. 7A

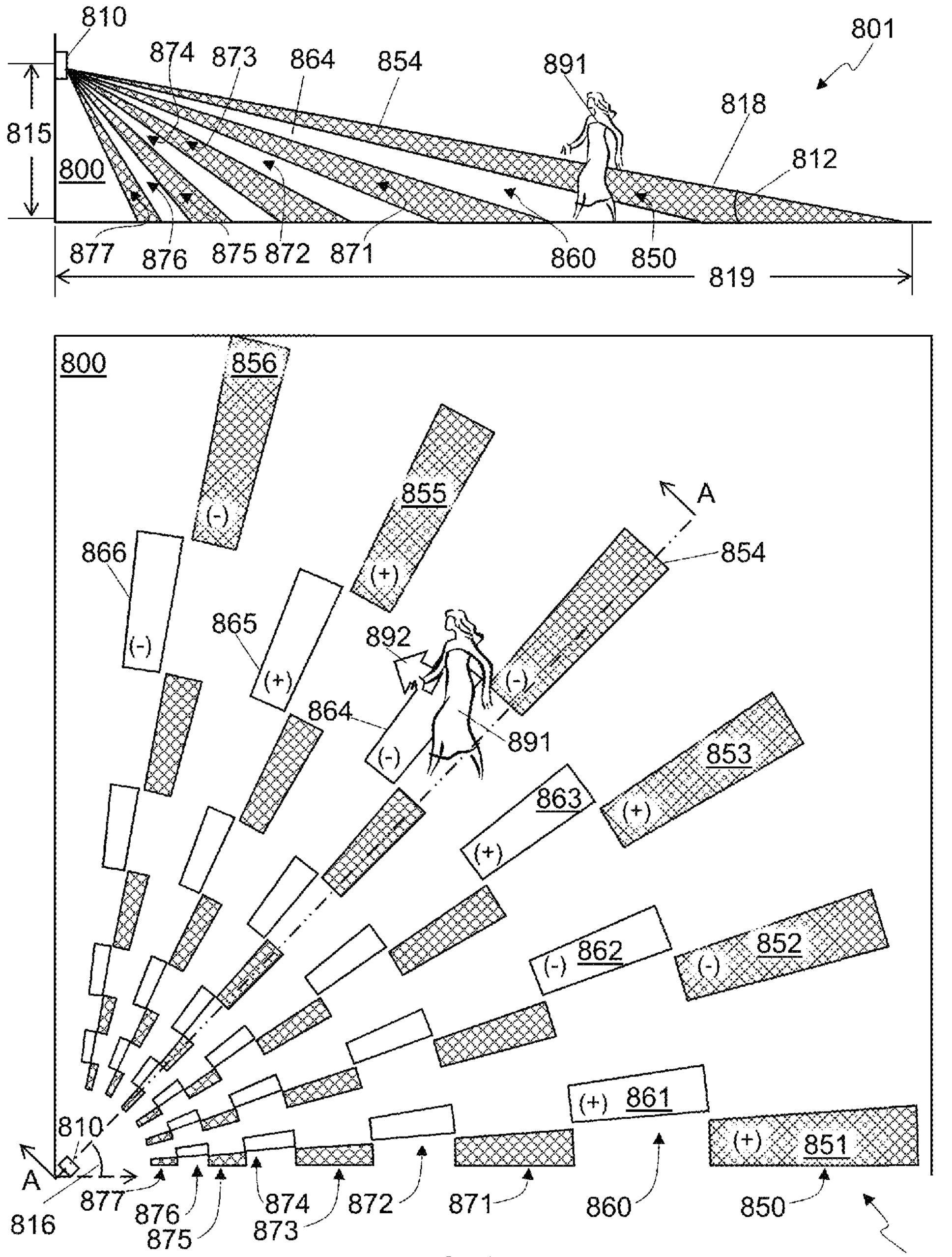
810
874
873
864
854
891
801
818
812
815
800
877
876
875
872
871
860
850
819
800
856
855
A
854
866
865
892
864
891
853
863
862
852
861
851
810
A
816
877
876
875
874
873
872
871
860
850
802
(-)
(+)

FIG. 8

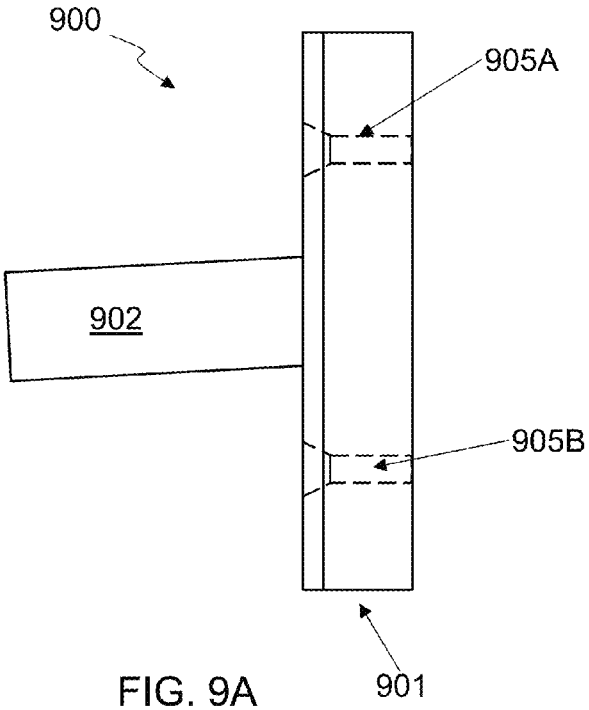

FIG. 9A

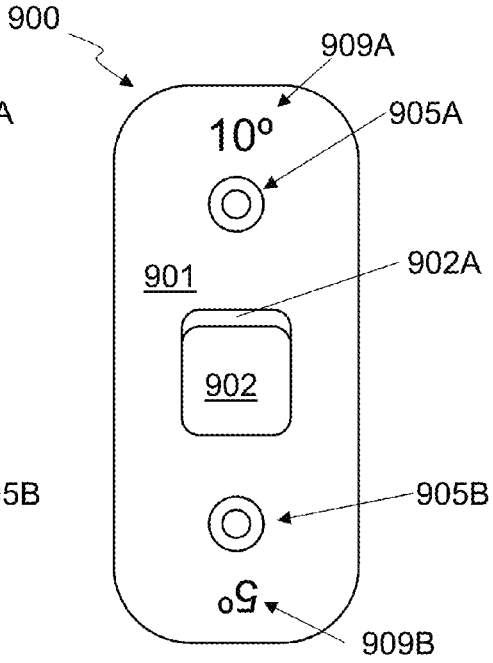

FIG. 9B

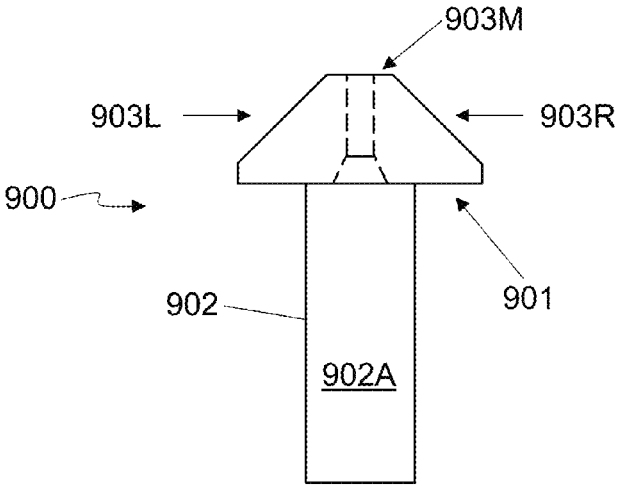

FIG. 9C

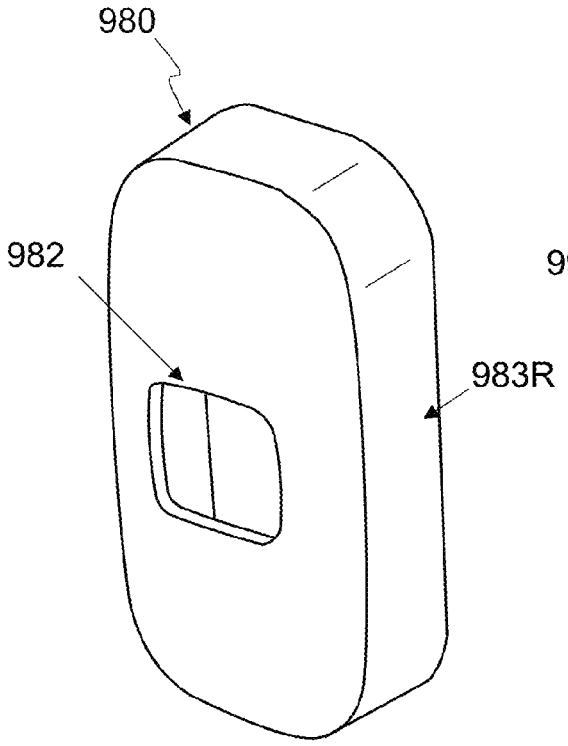

FIG. 9D

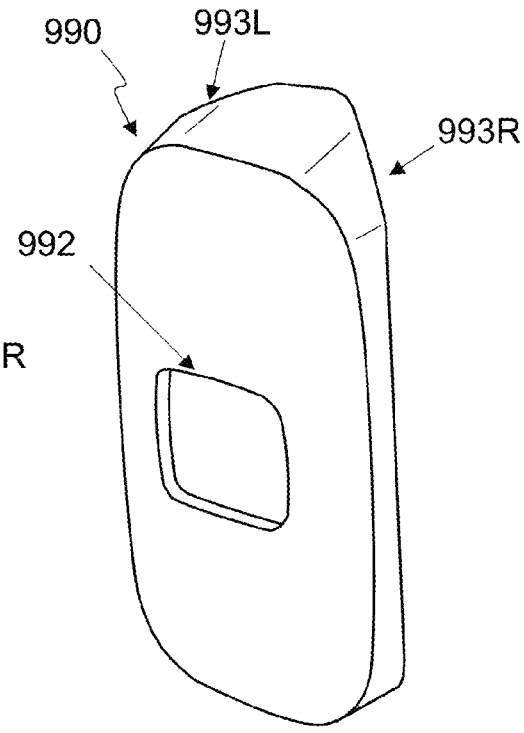

FIG. 9E

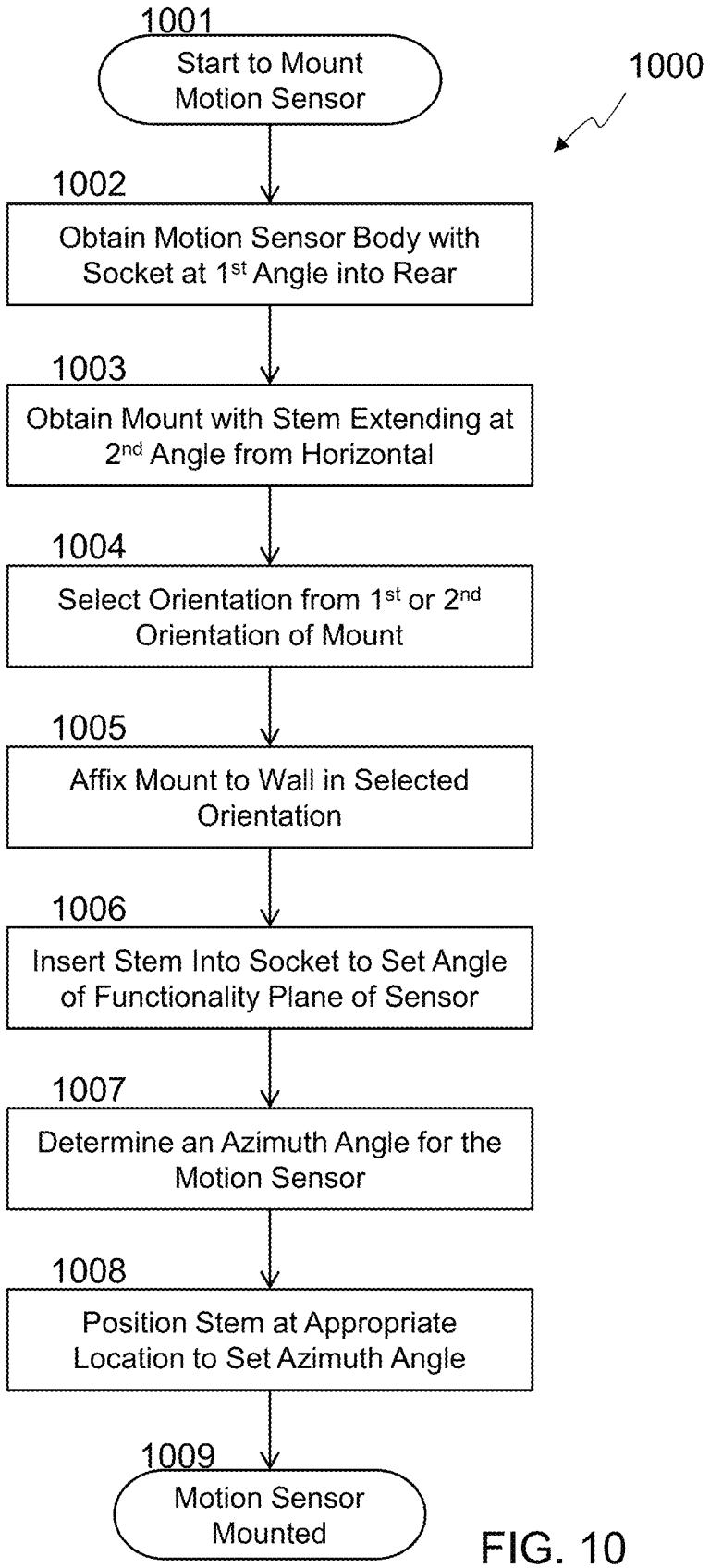
1001
Start to Mount Motion Sensor
1000
1002
Obtain Motion Sensor Body with Socket at 1st Angle into Rear
1003
Obtain Mount with Stem Extending at 2nd Angle from Horizontal
1004
Select Orientation from 1st or 2nd Orientation of Mount
1005
Affix Mount to Wall in Selected Orientation
1006
Insert Stem Into Socket to Set Angle of Functionality Plane of Sensor
1007
Determine an Azimuth Angle for the Motion Sensor
1008
Position Stem at Appropriate Location to Set Azimuth Angle
1009
Motion Sensor Mounted

FIG. 10

DUAL FIXED ANGLE SECURITY MOUNT

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. Provisional Patent Application No. 62/006,284, filed the same day as the present application and entitled "Magnetic Mount for Security Device," the entire contents of which are hereby incorporated by reference for any and all purposes. This application is also related to International Patent Application No. PCT/US2013/073799, filed on Dec. 9, 2013 and entitled "Motion Detection," the entire contents of which are hereby incorporated by reference for any and all purposes.

BACKGROUND

1. Technical Field

The present subject matter relates to mounts for security devices. More specifically it relates to a mount providing two different fixed angles for a security device.

2. Background Art

Many types of security devices are in common use today. Examples of security devices include, but are not limited to, motion sensors such as infrared motion sensors and ultrasonic motion sensors, security cameras such as still image cameras, visible wavelength video cameras, and cameras sensitive to invisible wavelengths such as infrared or ultraviolet, light beam interruption sensors, chemical detectors such as smoke alarms, carbon dioxide detectors, and explosive gas detectors, sound detection devices such as glass breakage detectors or microphones, water sensors, and pressure sensors. Some security devices have specific mounting requirements and are mounted in a specific place and/or orientation to properly operate. Some security devices have a specific detection pattern or direction of sensitivity that is pointed in the proper direction to allow for detection of the threat from a specific location.

Some security devices are designed to be used with a particular mount. One type of mount that is commonly used is a tilt and swivel adapter that is attached to a standard electrical junction box. Such a tilt and swivel mount allows the installer or user to change the azimuth and elevation of the security device to virtually any angle, providing a great deal of flexibility. Such a mount can be useful for some applications where a wide range of angles are needed for different installation situations.

Some security devices are designed to operate at a specific angle for their azimuth and/or elevation. In some cases, a specific mount is supplied with the security device to provide for the one specific angle. One example of this is a security device to be mounted on a ceiling and designed to point straight down, so the mount is designed to hold the security device in that position and is provided with the security device.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute part of the specification, illustrate various embodiments. Together with the general description, the drawings serve to explain various principles. In the drawings:

FIGS. **1**A and **1**B show an embodiment of a motion sensor body on a mount, where the mount is oriented in a first orientation in FIG. **1**A and in a second orientation in FIG. **1**B;

FIGS. **1**C and **1**D show oblique views from the front upper right and the rear lower left, respectively, of the same embodiment of the motion sensor with the mount in the first orientation as shown in FIG. **1**A;

FIG. **1**E shows a rear view of the embodiment of the motion sensor body of FIG. **1**A-D;

FIGS. **2**A and **2**B show vertical cross-sectional views of an embodiment of a security apparatus mounted with its functional plane at two different fixed angles, respectively, as determined by the orientation of the mount;

FIG. **3** shows a horizontal cross-sectional view of an embodiment of a security apparatus with a fixed azimuth angle;

FIG. **4** shows a rear view of another embodiment of a sensor body of a security apparatus similar to the security apparatus of FIG. **1**A-D but with a fixed azimuth angle;

FIGS. **5**A and **5**B show horizontal cross-sectional views of an embodiment of a security apparatus set to two different azimuth angles;

FIGS. **6**A and **6**B show horizontal cross-sectional views of an alternative embodiment of a security apparatus set to two different azimuth angles;

FIG. **7**A shows a vertical cross-sectional view of an embodiment of a security apparatus with the stem of the mount held in the socket by a snap-in mechanism;

FIG. **7**B shows a rear view of the socket of the embodiment of the sensor body of the security apparatus of FIG. **7**A;

FIG. **8** shows a side view and a top view of a detection pattern for an embodiment of a motion sensor;

FIG. **9**A-C show a three view orthographic projection of an embodiment of a mount suitable for embodiments;

FIGS. **9**D and **9**E show two different embodiments of covers for the mount of FIG. **9**A-C; and

FIG. **10** shows a flowchart of an embodiment of a method of mounting a motion sensor.

DETAILED DESCRIPTION

In the following detailed description, numerous specific details are set forth by way of examples in order to provide a thorough understanding of the relevant teachings. However, it should be apparent to those skilled in the art that the present teachings may be practiced without such details. In other instances, well known methods, procedures and components have been described at a relatively high-level, without detail, in order to avoid unnecessarily obscuring aspects of the present concepts. A number of descriptive terms and phrases are used in describing the various embodiments of this disclosure. These descriptive terms and phrases are used to convey a generally agreed upon meaning to those skilled in the art unless a different definition is given in this specification. Some descriptive terms and phrases are presented in the following paragraphs for clarity.

Magnetic material is a material that may be attracted to a magnet. Magnetic material may or may not remain magnetized without an external magnetic field. Examples of magnetic material include a magnet, steel, or other ferromagnetic materials.

A magnet is a magnetic material that generates a magnetic field, or is magnetized, even if the magnet is not being subjected to an external magnetic field. A magnet may also be referred to as a permanent magnet.

Ferromagnetic material, for the purposes of this disclosure, including the claims, refers to a magnetic material that does not generate a significant magnetic field of its own, or is not magnetized, without the presence of an external magnetic field. Ferromagnetic materials are attracted to a magnet. Fer-

romagnetic materials may include iron, nickel, cobalt, and many of their alloys, such as many steel alloys, as well as some compounds of rare earth metals. For the purposes of this disclosure, ferromagnetic materials include ferrimagnetic materials that are attracted to a magnet.

A security apparatus is an apparatus used for some type of security or monitoring application such as monitoring an area for some type of activity or event or providing an area with acoustical waves or electro-magnetic radiation such as radio waves, or light in the visible or invisible spectrum. Examples of a security apparatus include, but are not limited to, motion sensors such as infrared motion sensors and ultrasonic motion sensors, occupancy sensors, cameras such as still image cameras, visible wavelength video cameras, and cameras sensitive to invisible wavelengths such as infrared or ultraviolet, light beam interruption sensors, chemical detectors such as smoke alarms, carbon dioxide detectors, and explosive gas detectors, sound detection devices such as glass breakage detectors or microphones, water sensors, pressure sensors, speakers, ultrasonic transducers, infrared illumination sources, and visible light illumination sources.

One example of a security apparatus is a motion sensor designed to monitor an area of about 16'×16' (about 5 meters squared) for minor body movement and an area of about 20'×20' (about 6 meters squared) for major body motion. A mount is included to allow the motion sensor to be mounted within a one of two height ranges at the discretion of the installer: about 6' 6"-8' 6" (~2 m-2.6 m) or about 8' 6"-11' 10" (~2.6 m-~3.6 m). If the motion sensor is to be mounted in the higher height range, the mount is attached to the wall in a first orientation, but if the motion sensor is to be mounted in the lower height range, the mount is attached to the wall in a second orientation.

The mount can be mounted along a vertical line on a flat wall or in a corner. Two holes can be drilled on the vertical line to accommodate the two mounting screw holes in the base of the mount. To attach the mount to the wall in the first orientation, the mount is installed with the stem sloping downward and the "10°" marking upright. To attach the mount to the wall in the second orientation, the mount is stalled with the stem sloping upward and the "5°" marking upright. Once the mount is attached to the wall, the socket on the back of the motion sensor is slipped on the stem with the motion sensor upright. If the mount was installed in the first orientation, the motion sensor will look like it is pointed about 10° down, but if the mount was installed in the second orientation, the motion sensor will look like it is pointed about 5° down. This is accomplished due to the elevation angle of the motion sensor being dependent on the angle between the socket and the horizontal plane of the motion sensor, the angle of the stem from horizontal, and the orientation of the mount.

In one example, the angle between the socket and the horizontal plane of the motion sensor is about 7.5° and the angle of the stem from horizontal is about 2.5°. If the mount is attached to the wall in the first orientation with the stem sloping downward, the angle of the motion sensor from horizontal is equal to the angle between the socket and the horizontal plane of the motion sensor plus the angle of the stem from horizontal, or about 7.5°+2.5°=10°. If the mount is attached to the wall in the second orientation with the stem sloping upward, the angle of the motion sensor from horizontal is equal to the angle between the socket and the horizontal plane of the motion sensor minus the angle of the stem from horizontal, or about 7.5°−2.5°=5°.

The example motion sensor can monitor an area about +/−45° from its pointing direction for a total azimuth coverage range of about 90°. Thus, an entire room can be covered by mounting the sensor in one corner. For other applications, the motion sensor can be mounted on a flat wall and an azimuth angle selected for the motion sensor by positioning the stem of the mount at an appropriate location within the socket.

Reference now is made in detail to the examples illustrated in the accompanying drawings and discussed below.

FIGS. **1**A and **1**B show an embodiment of a motion sensor body **110** on a mount **120**, where the mount **120** is oriented in a first orientation in FIG. **1**A and in a second orientation in FIG. **1**B. FIGS. **1**C and **1**D show oblique views from the front upper right and the rear lower left, respectively, of the same embodiment of the motion sensor **100** with the mount **120** in the first orientation as shown in FIG. **1**A. The motion sensor **100** includes the motion sensor body **110** and the mount **120**, which is separable from the motion sensor body **110** and capable of being mounted in at least a first orientation or a second orientation. The motion sensor body **110** may include a top side **115** which is positioned at the top of the motion sensor body **110** when the motion sensor body **110** is in an upright position and configured for normal functionality of the motion sensor **100**.

The motion sensor **100** has a detection pattern extending from the front of the motion sensor body **110**. The shape of the motion sensor pattern varies between embodiments, but in general is bounded on the top by a functionality plane of the motion sensor body which emanates from the front of the motion sensor body **110** at an elevation angle that typically is measured as some number of degrees from horizontal when the motion sensor body **110** is positioned with its top side **115** up.

The motion sensor body **110** also includes a back side **111** that faces away from the detection area of the motion sensor **100**. A socket **112** is recessed into the back side **111** of the motion sensor body **110** at an angle to the functionality plane which may be called a first angle. Any exterior portions of the socket **112** protruding from the motion sensor body **110** are considered a part of the back side **111** so even if the socket **112** does not extend past the plane of the flat part of the back side **111** into the motion sensor body **110**, the socket **112** can be considered to be recessed into the back side **111** of the motion sensor body **110**. The socket **112** includes a top wall **112**T and a bottom wall which are substantially flat, as well as a rear-facing surface **112**R which may be curved and may include a magnetic material.

The mount **120** includes a base **121** and a stem **122** which may be separate pieces or may be formed together as a single article. The base **121** is designed to be attached to a vertical wall **102** in either a first orientation as shown in FIG. **1**A or a second orientation as shown in FIG. **1**B. Any type of attachment can be used, according to the embodiment, including, but not limited to, glue, nails, tape, double-sided adhesive pads, magnetic attraction, or screws. In the embodiment shown, a first screw hole **125**A and a second screw hole **125**B in the base **121** can be used with screws to affix the mount **120** to the vertical wall **102**. In the first orientation, a substantially flat first side **122**A of the stem **122** is facing up and a first end **121**A of the base **121** is at the top of the mount **120** as shown in FIG. **1**A. In the second orientation, a substantially flat second side **122**B of the stem **122** is facing up and a second end **121**B of the base **121** is at the top of the mount **120** as shown in FIG. **1**B. The first side **122**A is the opposite side of the stem **122** from the second side **122**B. In the first orientation of the mount **120**, a first marking "A" **129**A is upright, but in the second orientation of the mount **120**, a second marking "B" **129**B is upright. The markings can be any word, number

and/or symbol and can be useful to the person attaching the mount **120** to the wall **102** to determine which orientation the mount **120** is in.

A proximal end of the stem **122** is attached to the base **121**, and a distal end of the stem **122** is formed to fit into the socket **112** with the first side **122**A and second side **122**B in close proximity to the top wall **112**T and bottom wall of the socket **112**. In some embodiments, the distal end of the stem **122** includes a magnetic material, so the magnetic material is near the distal end of the stem **122**. The stem **122** extends from the base **121** at a second angle from horizontal. The second angle can be any angle, depending on the embodiment, but in some embodiments, the second angle is between about 2 degrees and about 25 degrees, and in at least one embodiment, the second angle is about 2.5 degrees.

FIG. **1**A and FIG. **1**B show the motion sensor body **110** in an upright position and the stem **122** of the mount **120** inserted into the socket **112** where it may be held in place by magnetic attraction between the first magnetic material and the second magnetic material in some embodiments. In FIG. **1**A with the mount in the first orientation, the angle of the motion sensor body **110** with respect to the mount **120** is set so that the functionality plane of the motion sensor body **110** is set at an angle from horizontal equal to the first angle plus the second angle. In FIG. **1**B with the mount in the second orientation, the angle of the motion sensor body **110** with respect to the mount **120** is set so that the functionality plane of the motion sensor body **110** is set at an angle from horizontal equal to the first angle minus the second angle. The first angle is the angle between the functionality plane and a central axis of the socket **112** and the second angle is the angle between the central axis of the stem **122** and horizontal when the mount **120** is affixed to a vertical wall **102**.

FIG. **1**E shows a rear view of the embodiment of the motion sensor body **110**. The motion sensor body **110** has a top side **115** and a back side **111** with the socket **112** recessed into the back side **111**. The socket **112** includes a curved rear-facing surface **112**R between the top wall **112**T and the bottom wall **112**B, that in some embodiments includes a magnetic material, such as steel. In at least one embodiment, the steel magnetic material snaps into a cavity on the back side **111** of the motion sensor body **110** to form at least part of the socket **112**.

In at least one embodiment, the curved rear-facing surface **112**R of the socket **112** is shaped as a section of a sphere with a given diameter, and the distal end of the stem **122** is shaped as a section of a sphere with a diameter about the same as the given diameter. In another embodiment, the curved rear-facing surface **112**R of the socket **112** is shaped as a section of a cylinder with a given diameter, and the distal end of the stem **122** is shaped as a section of a cylinder with a diameter about the same as the given diameter. The distal end of the stem **122** is positionable at a first location in the socket **112** to set the motion sensor body **110** at a first azimuth angle from the stem **122**, and the distal end of the stem **122** is positionable at a second location in the socket **112** to set the motion sensor body **110** at a second azimuth angle from the stem **122**.

FIGS. **2**A and **2**B show vertical cross-sectional views of an embodiment of a security apparatus **200** mounted with its functional plane **218** at two different fixed angles, respectively, as determined by the orientation of the mount **220**. The security apparatus **200** includes a sensor body **210** and a mount **220**. The security apparatus **200** can be any type of device used for a security application including, but not limited to, a camera or any type, a motion sensor, a light beam interruption sensor, a chemical detector, or a sound detector.

The sensor body **210** includes a socket **212** is recessed into the sensor body **210** at a first angle **219** from a functionality plane **218** of the sensor body **210**. The vector **230** shows the centerline of the socket **212** as well as the centerline of the stem **222**. The socket **212** includes a first wall **212**T and a second wall **212**B opposite from the first wall **212**T. In at least one embodiment, the first wall **212**T and the second wall **212**B are substantially flat, and a distance from the first wall **212**T to the second wall **212**B at an inside portion of the socket **212** is less than a distance from the first wall **212**T to the second wall **212**B at an outside portion of the socket **212** so that the socket **212** is tapered.

The functionality plane **218** extends from the sensor body **210** and may depend on the functionality of the security apparatus **200**. In at least one embodiment where the security apparatus **200** is a motion sensor with a fixed detection pattern, the functionality plane **218** is a plane bounding the top of the detection pattern. In some other embodiments where the security apparatus **200** is a camera, the functionality plane is a plane bisecting a field of view of the camera or bounding an edge of the field of view. In some other embodiments where the security apparatus **200** is a sound detection device, the functionality plane is set to the plane of highest sensitivity of the sound detector. In some embodiments, the functionality plane is not tied to the actual function of the security apparatus **200**, but is simply an arbitrary plane extending from the sensor body **210**, such as a plane bisecting the sensor body **210**.

The mount **220** includes a base **221** and a stem **222**. The base **221** is adapted to be affixed at a mounting plane. In FIG. **2**A and FIG. **2**B the mounting plane is aligned with a vertical wall **202**. A proximal end of the stem **222** is attached to the base **221**, and a distal end of the stem **222** is formed to fit into the socket **212**. The stem **222** has a first side **222**A and a second side **222**B opposite from the first side **222**A. In at least one embodiment, the first side **212**A and the second side **21**B are substantially flat sides and the stem **212** is tapered from the distal end to the proximal end to fit into the socket **212**. The centerline **230** of the stem **222** extends from the base **221** at a second angle **226** from a normal vector that is perpendicular to the mounting plane. The second angle **226** can be any angle, depending on the embodiment, but in some embodiments, the second angle **226** is between about 2° and about 25°, and in at least one embodiment, the second angle **226** is about 2.5°.

The angle **232**A/B of the functionality plane **218** with respect to the normal vector **234** to the mounting plane is different depending on how the stem **222** is inserted into the socket. The mounting plane can have any orientation, but in the embodiment shown in FIG. **2**A/B, the mounting plane is aligned with the vertical wall **102** making the normal vector **234** a horizontal vector in the embodiment. In FIG. **2**A the stem **222** is inserted into the socket **112** with the first side **222**A of the stem **222** in close proximity to the first wall **212**T of the socket **212** and the second side **222**B of the stem **222** in close proximity to the second wall **212**B of the socket **212**. A first end **221**A of the base **221** may be oriented up with the base **221** attached to the vertical wall **202**. With the stem **222** inserted as such, the functionality plane **218** of the sensor body **210** is set at an angle **232**A from the normal vector **234** equal to the first angle **219** plus the second angle **226**.

In FIG. **2**B the stem **222** is inserted into the socket **112** with the first side **222**A of the stem **222** in close proximity to the second wall **212**B of the socket **212** and the second side **222**B of the stem **222** in close proximity to the first wall **212**T of the socket **212**. A first end **221**A of the base **221** may be oriented down with the base **221** attached to the vertical wall **202**. With the stem **222** inserted as such, the functionality plane **218** of

the sensor body **210** is set at an angle **232**B from the normal vector **234** equal to the first angle **219** minus the second angle **226**.

In some embodiments, the first angle **219** between the functionality plane **218** and the socket **212** is between 0° and 45° and the second angle is about 2.5° so that the difference between the angle of the functionality plane and the normal vector **234** to the mounting plane between the two ways of inserting the stem **222** into the socket **212** is about 5°. In at least one embodiment, the first angle **219** is about 27.5° and the second angle **226** is about 2.5° making the angle **232**A with the stem **222** inserted into the socket in the first way equal to about 30° and the angle **232**B with the stem **222** inserted into the socket in the second way equal to about 25°. In at least one other embodiment, the first angle **219** is about 7.5° and the second angle **226** is about 2.5° making the angle **232**A with the stem **222** inserted into the socket in the first way equal to about 10° and the angle **232**B with the stem **222** inserted into the socket in the second way equal to about 5°.

FIG. **3** shows a horizontal cross-sectional view of an embodiment of a security apparatus **300** with a fixed azimuth angle. The security apparatus **300** may have a vertical cross-section that is similar to the security apparatus **200** shown in FIG. **2**A/B. The security apparatus **300** includes a sensor body **310** with a socket **312** recessed into the sensor body **310** at an angle to a centerline **340** of the sensor body **310**. In some embodiments, the angle between the angle of the socket **312** and the centerline **340** may be about 0° as is shown in FIG. **3**.

The security apparatus **300** includes a mount **320** with a stem **322** formed to fit into the socket **312**. The shape of the socket **312** and the stem **322** can be any shape, depending on the embodiment, as long as the stem **322** can be inserted into the socket **312**. In at least one embodiment, the socket **312** and the stem **322** are round and the sensor body **310** can rotate around the centerline of the stem **322**. In other embodiments, the stem **322** and the socket **312** have 4 flat sides so that the sensor body **310** cannot rotate around the stem **322**. In some embodiments, the shape of the stem **322** and socket **312** are substantially rectangular so that the stem **322** can be inserted into the socket **312** in only two different ways as described for FIG. **2**A/B above. In other embodiments, the shape of the stem **322** and socket **312** are substantially square so that the stem **322** can be inserting into the socket **312** in four different ways, at least two of which are consistent with the two different ways as described for FIG. **2**A/B above. In at least one embodiment, the motion sensor body **310** is set to a substantially fixed position once the stem **322** is inserted into the socket **312** with an azimuth angle of about zero degrees from the stem **322**.

In some embodiments, the socket **312** includes a first magnetic material **313**, the end of the stem **322** includes a second magnetic material **328**, and the stem **322** is held in the socket **312** by magnetic force. In some embodiments, the first magnetic material **313** and the second magnetic material **328** are magnets oriented to attract one another. In other embodiments, the first magnetic material **313** is a ferromagnetic material such as steel, and the second magnetic material **328** is a magnet. Any type of magnet can be used, depending on the embodiment, but in at least one embodiment, the second magnetic material **328** is a neodymium magnet. The strength of the magnet may vary between embodiments depending on the mass of the sensor body **310**, distance between the first magnetic material **313** and the second magnetic material **328**, the type and size of the first magnetic material **313** and the second magnetic material **328**, and the application. The magnet may be chosen to allow the stem **322** to be easily pulled from the socket **312** by a person, but to still have enough force to keep the stem **322** from being easily dislodged from the socket **312** if bumped or subjected to normal building vibrations. In at least one embodiment, the magnet used for the magnetic material **328** is chosen to exert about 2 pounds of force (about 10 Newtons) between the mount **320** and the sensor body **310**.

FIG. **4** shows a rear view of another embodiment of a sensor body **410** of a security apparatus similar to the security apparatus of FIG. **1**A-D but with a fixed azimuth angle. The sensor body **410** has a socket **412** recessed into a back side **411** of the sensor body **410**. The socket **412** is formed to hold a stem of a mount by having 4 sides that fit in close proximity to the 4 sides of the stem so that the sensor body **410** is set to a substantially fixed position with respect to the mount when the stem is inserted into the socket **412**. In at least one embodiment, the fixed position of the sensor body **410** has an azimuth angle that is about zero degrees from the stem. While in some embodiments, a stem can be inserted into the socket **412** in four different ways, at least two of the ways are consistent with the two different ways as described for FIG. **2**A/B above.

FIGS. **5**A and **5**B show horizontal cross-sectional views of an embodiment of a security apparatus **500** set to two different azimuth angles. The security apparatus **500** may have a vertical cross-section that is similar to the security apparatus **200** shown in FIG. **2**A/B. The security apparatus **500** includes a sensor body **510** and a mount **520**. The sensor body **510** includes a socket **512** recessed into back of the sensor body **510** with two substantially flat walls, a top wall (not shown) and a bottom wall **512**B opposite from the top wall, and a concave rear-facing curved surface **512**R between the top wall and the bottom wall. The shape of the concave rear-facing curved surface **512**R may be a section of a cylinder with a given radius, a section of a sphere with a given radius, or some other shape, depending on the embodiment.

The mount **520** includes a stem **522** formed to fit between the top wall and the bottom wall **512**B of the socket **512**. The shape of the end of the stem **522** may be a section of a cylinder with about the same radius as the cylinder used for the curved surface **512**R of the socket **512**, a section of a sphere with about the same radius as the sphere used for the curved surface **512**R of the socket **512**, or some other shape. The end of the stem **522** is variably positionable in the socket **512** to set the sensor body **510** at a plurality of azimuth angles between a first azimuth angle **542**A and a second azimuth angle **542**B. In some embodiments, the sensor body **510** is pivotable on the stem **522** in a plane parallel to the stem **522** to set the azimuth angle. The azimuth angle **542**A/B in at least some embodiments is measured between a centerline **530** of the stem **522** and a centerline **540** of a functional area of the sensor body **510**. In at least one embodiment, the first azimuth angle **542**A is equal to about 45 degrees to the right of the stem, and the second azimuth angle **542**B is equal to about 45 degrees to the left of the stem.

In some embodiments, the socket **512** includes a first magnetic material **513**, the end of the stem **522** includes a second magnetic material **528**, and the stem **522** is held in the socket **512** by magnetic force. In some embodiments, the first magnetic material **513** is a ferromagnetic material such as steel, and the second magnetic material **528** is a magnet. Any type of magnet can be used, depending on the embodiment, but in at least one embodiment, the second magnetic material **528** is a neodymium magnet. The strength of the magnet may vary between embodiments depending on the mass of the sensor body **510**, distance between the first magnetic material **513** and the second magnetic material **528**, the type and size of the first magnetic material **513** and the second magnetic material **528**, and the application. The magnet may be chosen to allow

the stem **522** to be easily moved within the socket **512** or pulled from the socket **512** by a person, but still have enough force to keep the stem **522** from being easily moved in the socket **512** if bumped or subjected to normal building vibrations. In at least one embodiment, the magnet used for the magnetic material **528** is chosen to exert about 5 pounds of force (about 20 newtons) between the mount **520** and the sensor body **510**. The force used for this embodiment may be higher than the force used for the embodiment of FIG. **3**A/B because the embodiment of FIG. **3**A/B holds the stem **322** on all four sides and allows for less movement of the stem than the embodiment of FIG. **5**A/B which only holds the stem **522** on two sides.

FIGS. **6**A and **6**B show horizontal cross-sectional views of an alternative embodiment of a security apparatus **600** set to two different azimuth angles. The security apparatus **600** may have a vertical cross-section that is similar to the security apparatus **200** shown in FIG. **2**A/B. The security apparatus **600** includes a sensor body **610** and a mount **620**. The sensor body **610** includes a socket **612** recessed into back of the sensor body **610** with two substantially flat walls, a top wall (not shown) and a bottom wall **612**B opposite from the top wall, and a concave rear-facing curved surface **612**R between the top wall and the bottom wall. In embodiments, the concave rear-facing curved surface **612**R includes two or more magnets placed near the socket with a magnetic pole facing into the socket.

The mount **620** includes a stem **622** formed to fit between the top wall and the bottom wall **612**B of the socket **612**. The end of the stem **622** is variably positionable in the socket **612** to set the sensor body **610** at a plurality of azimuth angles. The end of the stem **622** includes a magnetic material **628** which in some embodiments is a magnet with an opposite magnetic pole facing the end of the stem. The azimuth angle **642**A/B in at least some embodiments is measured between a centerline **630** of the stem **622** and a centerline **640** of a functional area of the sensor body **610**.

The security apparatus **600** includes a first alignment mechanism to position the end of the stem **622** at a first location in the socket **612** to set the sensor body **610** to a first azimuth angle **642**A of about 45 degrees The first alignment mechanism includes a first magnet **613**A near the first location in the socket **612** to attract the magnetic material **628** in the stem.

The security apparatus **600** includes a second alignment mechanism to position the end of the stem **622** at a second location in the socket **612** to set the sensor body **610** to a second azimuth angle **642**B of about −45 degrees. The second alignment mechanism includes a second magnet **613**B near the second location in the socket **612** to attract the magnetic material **628** in the stem.

The security apparatus **600** includes a third alignment mechanism to position the end of the stem **622** at a third location in the socket **612** to set the sensor body **610** to a third azimuth angle of about 0 degrees The third alignment mechanism includes a third magnet **613**C near the third location in the socket **612** to attract the magnetic material **628** in the stem.

In at least one embodiment, the magnetic material **628** includes a magnet with its north pole facing the socket. In those embodiments, the first magnet **613**A is placed near the socket **612** with its south pole facing into the socket **612**, the second magnet **613**B is placed near the socket **612** with its south pole facing into the socket **612**, and the third magnet **613**C is placed near the socket **612** with its south pole facing into the socket **612**

In other embodiments, end of the stem is held in the socket by friction between first and second walls of the socket and first and second sides of the stem, or a snap-in mechanism. FIG. **7**A shows a vertical cross-sectional view of an embodiment of a security apparatus **700** with the stem **722** of the mount **720** held in the socket **712** by a snap-in mechanism. The security apparatus **700** includes a sensor body **710** with the socket **712** recessed into the back of **711** the sensor body **710**. A portion of the back of the sensor body **711** including the socket **712** is shown in FIG. **7**B. The socket **712** includes a slot **715** in the rear surface **712**R of the socket **712** backed by a cavity **716**. In some embodiments, the slot **715** includes one or more detents, such as the first detent **717**A, the second detent **717**B, and the third detent **717**C which may be wide points in the slot **715**. The stem **722** has a protrusion extending from the end of the stem **722** that includes a head **726** and a neck **724**. The head **726** is adapted to be pushed through the slot **715** into the cavity **716** with the neck **724** extending through the slot **715**. The head **726** is further adapted to not easily pull back through the slot **715**, which may be accomplished by an arrow-head shape to the head **726**. In some embodiment, the neck **724** may be sized to fit tightly in the slot **715** so that there is a resistance to move the neck **724** out of one of the detents **717**A-C. In some embodiments, the head **726** and neck **724** may have a slot cut through them to allow them to more easily contract and expand.

The sensor body **710** can then be positioned at various azimuth angles by sliding the neck **724** through the slot **715**. An alignment mechanism, such as one of the detents **717**A-C, may be used to position the end of the stem **722** in a particular location in the socket **712** to set a particular azimuth angle. In other embodiments the alignment mechanism is a sub-socket, or deeper portion, the rear facing surface **712**R of the socket **712** to hold the end of the stem **722**, a detent on one of the walls of the socket **712**, or a visible marking on the sensor body **710**. In the embodiment shown, the first detent **717**A may be used to position the stem **722** at a first location in the socket **712** to set a first azimuth angle, the second detent **717**B may be used to position the stem **722** at a second location in the socket **712** to set a second azimuth angle, and the third detent **717**C may be used to position the stem **722** at a third location in the socket **712** to set a third azimuth angle of about 0 degrees. The stem **722** may also be positionable between the first location in the socket **712** and the second location in the socket **712** to vary the azimuth angle.

FIG. **8** shows a side view **801** and a top view **802**, respectively, of detection pattern for an embodiment of a motion sensor **810**. The detection pattern can also be thought us as monitored volumes of space by the motion sensor **810** in a room **800**. Side view **801** shows a vertical planar cross-section of the room **800** as shown by the cross-section line A:A in top view **802**. Looking first at the side view **801**, the motion sensor **810** is mounted on a wall of the room **800** at a height **815**. The detection pattern of the motion sensor **810** is bounded on its top by functionality plane **818** which extends from the motion sensor **810** at an election of an angle **812** below horizontal so that the functionality plane **818** also forms the angle **812** with the floor at a distance **819** from the motion sensor **810**. The motion sensor **810** is mounted at an azimuth angle **816** to set the coverage area of the detection pattern as shown in the top view **802**.

The motion sensor **810** monitors several tiers, or rows, of monitored volumes that project from the motion sensor **810** at different elevations. In the side view **801**, the monitored volumes without hatch lines, such as monitored volume **864**, are behind the cross-sectional plane A:A, and the monitored volumes with the hatch lines, such as monitored volume **854**, are intersected by the cross-sectional plane A:A. The various tiers intersect the floor of the room **800** in arcs, as shown in the top

view **802**. The locations where the even numbered tiers hit the floor are shown without hatch lines, and the locations where the odd numbered tiers hit the floor are shown with hatch lines in the top view **802**.

Looking now at both the side view **801** and the top view **802** together, the highest tier **850**, which includes the monitored volume **854**, is an odd numbered tier and includes monitored volumes **851-856**. The next even numbered tier **860** includes monitored volumes **861-866**. Additional alternating odd tiers **871**, **873**, **875**, **877** and even tiers **872**, **874**, **876** each include a set of monitored volumes. The number of tiers and number of monitored volumes per tier shown in FIG. **8** are shown as an example, but any detection pattern can be used depending on the embodiment.

A human **891** is shown in FIG. **8** moving through the room **800**. As the human **891** moves through the room **800** in the direction **892**, she passes through multiple monitored volumes of multiple tiers. At her initial location, the human **891** is intersecting monitored volume **854** of tier **850**. Infrared radiation generated by the warmth of her body is directed from the monitored volume **854** onto one or more detector elements in the motion sensor **810**. As the human **891** moves in the direction **892**, she moves out of the monitored volume **854** and into monitored volume **864**, followed by moving from monitored volume **864** into monitored volume **855** and so on. The motion sensor **810** detects that the infrared radiation has moved between monitored volumes and can use that information to indicate that motion has been detected. The motion sensor **810** can then generate one or more of an audible indication, such as a siren or warning voice, a visual indication, such as turning on a light, or a actuating a strobe light or rotating light, generating an indication on a wired circuit, such as closing a switch or sending an ethernet message, and/or sending a radio frequency message, such as a message sent over a Wi-Fi (IEEE 800.11) network or Zigbee (IEEE 802.15) network.

Note that a combination of the elevation angle **812** of the functionality plane **818** of the motion sensor **810** and the mounting height **815** of the motion sensor **810** determine the distance **819** from the motion sensor **810** that the detection pattern extends. So if a constant distance **819** for the detection pattern is desired, if the height **815** changes, the elevation angle **812** of the functionality plane **818** needs to change to keep the distance **819** constant. If motion sensor **810** has a body and a mount as shown in FIG. **1**A-E or FIG. **2**A/B, the orientation of the mount may be changed as the mounting height **815** is changed to keep a constant distance **819**.

In one example, the functionality plane extends **818** from the sensor body at an angle of about 27.5°. A mount is provided with a stem that protrudes from the base at an angle of about 2.5° from horizontal if the mount is attached to a vertical wall. So if the mount is attached to the vertical wall in the first orientation, the functionality plane **818** extends from the motion sensor at about 27.5°+2.5°=30°. If the mount is attached to the wall in the second orientation, the functionality plane **818** extends from the motion sensor at about 27.5°−2.5°=25°. So if it is desired that the distance **819** for the detection pattern to extend from the motion sensor **810** is about 16 feet (about 5 meters), a mounting height of about 9' 4" (about 2.8 meters) would extend the detection pattern to about 16 feet if the mount is attached to the wall in the first position, and a mounting height of about 7' 6" (about 2.3 meters) would extend the detection pattern to about 16 feet if the mount is attached to the wall in the second position. This can be shown by using a trigonometric formula to solve for the mounting height based on the distance **819** and the elevation angle **812** using the formula:

$$h=\tan(\alpha)\times d,$$

where α is the elevation angle **812**, d is the distance **819**, and h is the mounting height **815**.

This shows an example of selecting an orientation to use to affix the mount to the vertical wall based on a mounting height, a target coverage area, and the detection pattern of the motion sensor body. Once the orientation is selected, the mount can be affixed to the vertical wall in the selected orientation at the mounting height and the stem of the mount inserted into the socket with the motion sensor body in an upright position. In some embodiments, an azimuth angle **816** for the motion sensor body is also determined based on the target coverage area and the detection pattern of the motion sensor body. To set the azimuth angle, the end of the stem is inserted into the socket at an appropriate location in the socket to set the motion sensor body at the determined azimuth angle **816**.

FIG. **9**A-C show a three view orthographic projection of an embodiment of a mount **900** suitable for embodiments of a security apparatus. FIG. **9**A shows a side view, FIG. **9**B shows a front view, and FIG. **9**C shows a top view of the mount **900** in the first orientation. The mount includes a base **901** and a stem **902** extending from the base **901**. The base **901** of this embodiment is configured to be attached to either a flat surface or an interior corner of two surfaces where the surfaces may be vertical walls. The base **901** includes two screw holes **905**A, **905**B which can be used to attach the base **901** to either the flat surface or the interior corner. Other embodiments may use other mechanisms to attach the base **901** to the surface including, but not limited to, glue, nails, rivets, tape, double-sided sticky pads, magnetic attraction, or any other attachment mechanism. If the base **901** is attached to a flat surface, the back surface **903**M of the base **901** is held flush against the wall that is coincident with the mounting plane of the mount **900**. If the base **901** is attached to an interior corner of two surfaces that meet in the mounting plane of the mount with the normal vector of the mounting plane bisecting the interior corner, the left angled surface **903**L is held against one of the surfaces of the interior corner, and the right angled surface **903**R is held against the other surface of the interior corner.

The mount **900** is shown in the first orientation with the stem **902** sloping down, or extending from the base at an angle below a normal vector to the mounting plane. In the first orientation, the first side **902**A of the stem **902** is facing up, and the first screw hole **905**A is above the stem **902**. A first marking **909**A on the mount **900** is positioned to be upright if the mount **900** is affixed to a vertical surface in the first orientation. The mount **900** can also be attached to the vertical surface in a second orientation. In the second orientation, the first side **902**A of the stem **902** is facing down, a second side of the stem **902** opposite from the first side **902**A is facing up, and the second screw hole **905**B is above the stem **902**. A second marking **909**B on the mount **900** is positioned to be upright if the mount is affixed to the vertical surface in a second orientation with the second side of the stem facing up. The first marking **909**A and the second marking **909**B can be any type of marking but in at least one embodiment, the markings **909**A/B indicate an elevation angle for the security apparatus if the mount is affixed to the wall.

FIG. **9**D shows an embodiment of a cover **980** to hide the base **901** and mounting screws of the mount **900** of FIG. **9**A-C if the mount **900** is affixed to a flat surface. The cover **980** slides over the mount **900** with the stem **902** protruding through the hole **982**. In some embodiments, the cover **980** may snap into place over the base **901** to keep the cover **980**

in place. The sides of the cover, such as the right side **983**R, may cover the gap created by the angled surfaces **903**L/R of the base **901**.

FIG. **9**E shows an embodiment of a cover **990** to hide the base **901** and mounting screws of a mount **900** of FIG. **9**A-C if the mount **900** is affixed in an interior corner. The cover **990** slides over the mount **900** with the stem **902** protruding through the hole **992**. In some embodiments, the cover **990** may snap into place over the base **901** to keep the cover **990** in place. The right side **993**R and left side **993**L of the cover **990** fit into the corner where the mount **900** is attached.

FIG. **10** shows a flowchart **1000** of an embodiment of a method of mounting a motion sensor. The method starts to mount the motion sensor at block **1001** and a motion sensor body is obtained at block **1002**. The motion sensor body includes a socket and a detection pattern with a functionality plane bounding the top of the detection pattern. The socket is recessed into a back side of the motion sensor body at a first angle from the functionality plane of the motion sensor body.

The flowchart **1000** continues at block **1003** with obtaining a mount. The mount includes a base and a stem. The base is adapted to be affixed to a vertical wall in either a first orientation or a second orientation. A proximal end of the stem is attached to the base, and a distal end of the stem is formed to fit into the socket of the motion sensor body. The stem extends from the base at a second angle from horizontal.

An orientation is selected at block **1004** to use to affix the mount to the vertical wall, from either the first orientation or the second orientation, based on a mounting height, a target coverage area, and the detection pattern of the motion sensor body. The mount is affixed on the vertical wall at block **1005** in the selected orientation at the mounting height. At block **1006** the stem is inserted into the socket with the motion sensor body in an upright position to situate the motion sensor body on the mount. Once the stem is inserted into the socket on the motion sensor body, the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle plus the second angle if the mount is affixed to the vertical wall in the first orientation, and an angle from horizontal equal to the first angle minus the second angle if the mount is affixed to the vertical wall in the second orientation.

In some embodiments, the method also includes setting an azimuth angle. In such embodiments, the flowchart **1000** includes optional block **1007** to determine an azimuth angle for the motion sensor body based on the target coverage area and the detection pattern of the motion sensor body, and positioning the end of the stem at an appropriate location in the socket at optional block **1008** to set the motion sensor body at the determined azimuth angle. The method concludes at block **1009**.

Examples of various embodiments are described in the following paragraphs:

An example motion sensor includes a motion sensor body that includes a socket and a detection pattern with a functionality plane bounding the top of the detection pattern, wherein the socket is recessed into a back side of the motion sensor body at a first angle from the functionality plane of the motion sensor body and the socket comprises a substantially flat top wall, a substantially flat bottom wall opposite from the top wall, and a rear-facing surface comprising a first magnetic material. The example motion sensor also includes a mount that includes a base and a stem, the base adapted to be affixed to a vertical wall in either a first orientation with a substantially flat first side of the stem facing up, or a second orientation with a substantially flat second side of the stem facing up, a proximal end of the stem attached to the base, and a distal end of the stem comprising a second magnetic material and formed to fit into the socket with the first and second sides in close proximity to the top and bottom walls of the socket, wherein the stem extends from the base at a second angle from horizontal and the first side is the opposite side of the stem from the second side. With the example motion sensor body in an upright position and the stem of the mount inserted into the socket and held in place by magnetic attraction between the first magnetic material and the second magnetic material, the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle plus the second angle if the mount is affixed to the vertical wall in the first orientation, and the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle minus the second angle if the mount is affixed to the vertical wall in the second orientation. In some example motion sensors, the motion sensor body is set to a substantially fixed position with an azimuth angle of about zero degrees from the stem when the stem is inserted into the socket. In some example motion sensors, the second angle is about 2.5 degrees. Some example motion also include a first marking on the mount positioned to be upright if the mount is affixed to the vertical wall in the first orientation, and a second marking on the mount positioned to be upright if the mount is affixed to the vertical wall in the second orientation. In some example motion sensors, the base is adapted to be affixed at an interior corner of the vertical wall. In some example motion sensors, the socket further also includes a concave rear-facing curved surface between the top wall and the bottom wall, and the distal end of the stem is variably positionable in the socket to set the motion sensor body at a plurality of azimuth angles between a first azimuth angle and a second azimuth angle. Some example motion sensors also include a first alignment mechanism to position the distal end of the stem at a first location in the socket to set the motion sensor body to the first azimuth angle of about 45 degrees, a second alignment mechanism to position the distal end of the stem at a second location in the socket to set the motion sensor body to the second azimuth angle of about −45 degrees, and a third alignment mechanism to position the distal end of the stem at a third location in the socket to set the motion sensor body to a third azimuth angle of about 0 degrees. In some example motion sensors, the first magnetic material comprises steel shaped to form the rear-facing surface of the socket, and the second magnetic material comprises a magnet. Any combination of elements described in this paragraph may be used in various embodiments.

An example method of mounting a motion sensor includes obtaining a motion sensor body comprising a socket and a detection pattern with a functionality plane bounding the top of the detection pattern, wherein the socket is recessed into a back side of the motion sensor body at a first angle from the functionality plane of the motion sensor body, and obtaining a mount comprising a base and a stem, the base adapted to be affixed to a vertical wall in either a first orientation or a second orientation, a proximal end of the stem attached to the base, and a distal end of the stem formed to fit into the socket, wherein the stem extends from the base at a second angle from horizontal, The example method also includes selecting an orientation from the first orientation or the second orientation to use to affix the mount to the vertical wall based on a mounting height, a target coverage area, and the detection pattern of the motion sensor body, affixing the mount on the vertical wall in the selected orientation at the mounting height, and inserting the stem into the socket with the motion sensor body in an upright position to situate the motion sensor body on the mount. In the example motion sensor, the func-

tionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle plus the second angle if the mount is affixed to the vertical wall in the first orientation, and the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle minus the second angle if the mount is affixed to the vertical wall in the second orientation. Some example methods also include determining an azimuth angle for the motion sensor body based on the target coverage area and the detection pattern of the motion sensor body, and positioning the end of the stem at an appropriate location in the socket to set the motion sensor body at the determined azimuth angle. Any combination of elements described in this paragraph may be used in various embodiments.

An example security apparatus includes a sensor body comprising a socket, wherein the socket is recessed into the sensor body at a first angle from a functionality plane of the sensor body, the socket comprising a first wall and a second wall opposite from the first wall, and a mount comprising a base and a stem, the base adapted to be affixed at a mounting plane, a proximal end of the stem attached to the base, and a distal end of the stem formed to fit into the socket, wherein the stem extends from the base at a second angle from a normal vector that is perpendicular to the mounting plane and the stem comprises a first side and a second side opposite from the first side. In the example security apparatus, the functionality plane of the sensor body is set at an angle from the normal vector equal to the first angle plus the second angle if the stem is inserted into the socket with the first side of the stem in close proximity to the first wall of the socket, and the functionality plane of the sensor body is set at an angle from the normal vector equal to the first angle minus the second angle if the stem is inserted into the socket with the first side of the stem in close proximity to the second wall of the socket. Some example security apparatuses also include a first marking on the mount positioned to be upright if the mount is affixed to a vertical surface in a first orientation with the first side of the stem facing up, and a second marking on the mount positioned to be upright if the mount is affixed to the vertical surface in a second orientation with the second side of the stem facing up. In some example security apparatuses, the base is adapted to be affixed at an interior corner of two surfaces intersecting in the mounting plane. Some example security apparatuses also include comprising a cover to hide the base of the mount. In some example security apparatuses, the first wall and the second wall are substantially flat, and a distance from the first wall to the second wall at an inside portion of the socket is less than a distance from the first wall to the second wall at an outside portion of the socket, and the first side and the second side are substantially flat sides and the stem is tapered from the distal end to the proximal end to fit into the socket. In some example security apparatuses, the sensor body is set to a substantially fixed position with respect to the mount when the stem is inserted into the socket. In some example security apparatuses, the fixed position of the sensor body has an azimuth angle that is about zero degrees from the stem. In some example security apparatuses, the sensor body is pivotable on the stem in a plane parallel to the stem. In some example security apparatuses, the first wall and the second wall of the socket are substantially flat, and the socket further comprises a curved rear-facing surface between the first wall and the second wall, and the first side and second side of the stem are substantially flat and are formed to fit into the socket in close proximity to the first and second wall of the socket when the distal end of the stem is inserted into the socket. In some example security apparatuses, the distal end of the stem is positionable at a first location in the socket to set the sensor body at a first azimuth angle from the stem, and the distal end of the stem is positionable at a second location in the socket to set the sensor body at a second azimuth angle from the stem. In some example security apparatuses, the curved rear-facing surface of the socket is shaped as a section of a cylinder with a given diameter, and the distal end of the stem is shaped as a section of a cylinder with a diameter about the same as the given diameter. In some example security apparatuses, the curved rear-facing surface of the socket is shaped as a section of a sphere with a given diameter, and the distal end of the stem is shaped as a section of a sphere with a diameter about the same as the given diameter. In some example security apparatuses, the distal end of the stem is variably positionable in the socket to set the sensor body at a plurality of azimuth angles between the first azimuth angle and the second azimuth angle. In some example security apparatuses, the first azimuth angle is equal to about 45 degrees to the right of the stem, and the second azimuth angle is equal to about 45 degrees to the left of the stem. Some example security apparatuses also include a first alignment mechanism to position the distal end of the stem in the first location in the socket, a second alignment mechanism to position the distal end of the stem in the second location in the socket, and a third alignment mechanism to position the distal end of the stem in a third location in the socket to set the sensor body at an azimuth angle of about 0 degrees from the stem. In some example security apparatuses, an alignment mechanism is used to position the distal end of the stem in the first location in the socket. In some example security apparatuses, the alignment mechanism comprises a sub-socket or a detent in the rear-facing surface of the socket, a detent on the first or second wall of the socket, or a visible marking on the sensor body. In some example security apparatuses, security apparatus also includes a first magnet positioned near the distal end of the stem with a first magnetic pole facing the distal end of the stem, a second magnet placed near the first location in the socket with a magnetic pole opposite of the first magnetic pole facing into the socket, and a third magnet placed near the second location in the socket with a magnetic pole opposite of the first magnetic pole facing into the socket. In some example security apparatuses, the distal end of the stem is held in the socket by friction between first and second walls of the socket and first and second sides of the stem, or a snap-in mechanism. In some example security apparatuses, the socket comprises a first magnetic material, and the distal end of the stem comprises a second magnetic material, and the distal end of the stem is held in the socket by magnetic force. In some example security apparatuses, the first magnetic material comprises steel, and the second magnetic material comprises a magnet. In some example security apparatuses, the steel magnetic material snaps into a cavity on the back of the sensor body to form at least part of the socket. In some example security apparatuses, the magnet includes neodymium. In some example security apparatuses, the first magnetic material includes one or more magnets placed near the socket with a magnetic pole facing into the socket, and the second magnetic material includes a magnet with an opposite magnetic pole facing the distal end of the stem. In some example security apparatuses, the sensor body comprises a motion sensor with a fixed detection pattern. Any combination of elements described in this paragraph may be used in various embodiments.

As used in this specification and the appended claims, the singular forms “a”, “an”, and “the” include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to an element described as “a monitored volume” may refer to a single monitored volume, two moni-

tored volumes, or any other number of monitored volumes. As used in this specification and the appended claims, the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise. As used herein, the term "coupled" includes direct and indirect connections. Moreover, where first and second devices are coupled, intervening devices including active devices may be located there between. Unless otherwise indicated, all numbers expressing quantities of elements, percentages, and so forth used in the specification and claims are to be understood as being modified in all instances by the term "about." Interpretation of the term "about" is context specific, but in the absence of other indications, should generally be interpreted as ±5% of the modified quantity, measurement, or distance. The recitation of numerical ranges by endpoints includes all numbers subsumed within that range (e.g. 1 to 5 includes 1, 2.78, 3.33, and 5). Any element in a claim that does not explicitly state "means for" performing a specified function, or "step for" performing a specified function, is not to be interpreted as a "means" or "step" clause as specified in 35 U.S.C. §112(f).

The description of the various embodiments provided above is illustrative in nature and is not intended to limit the invention, its application, or uses. Thus, different variations beyond those described herein are intended to be within the scope of the embodiments of the present invention. Such variations are not to be regarded as a departure from the intended scope of the present invention. As such, the breadth and scope of the present invention should not be limited by the above-described exemplary embodiments, but should be defined only in accordance with the following claims and equivalents thereof.

What is claimed is:

1. A motion sensor comprising:

a motion sensor body comprising a socket and a detection pattern with a functionality plane bounding a top of the detection pattern, wherein the socket is recessed into a back side of the motion sensor body at a first angle from the functionality plane of the motion sensor body and the socket comprises a substantially flat top wall, a substantially flat bottom wall opposite from the top wall, and a rear-facing surface comprising a first magnetic material;

a mount comprising a base and a stem, the base adapted to be affixed to a vertical wall in either a first orientation with a substantially flat first side of the stem facing up, or a second orientation with a substantially flat second side of the stem facing up, a proximal end of the stem attached to the base, and a distal end of the stem comprising a second magnetic material and formed to fit into the socket with the first and second sides in close proximity to the top and bottom walls of the socket, wherein the stem extends from the base at a second angle from horizontal and the first side is an opposite side of the stem from the second side;

wherein, with the motion sensor body in an upright position and the stem of the mount inserted into the socket and held in place by magnetic attraction between the first magnetic material and the second magnetic material;

the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle plus the second angle if the mount is affixed to the vertical wall in the first orientation; and

the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle minus the second angle if the mount is affixed to the vertical wall in the second orientation.

2. The motion sensor of claim **1**, wherein the motion sensor body is set to a substantially fixed position with an azimuth angle of about zero degrees from the stem when the stem is inserted into the socket.

3. The motion sensor of claim **1**, wherein the second angle is about 2.5 degrees.

4. The motion sensor of claim **1**, further comprising:

a first marking on the mount positioned to be upright if the mount is affixed to the vertical wall in the first orientation; and

a second marking on the mount positioned to be upright if the mount is affixed to the vertical wall in the second orientation.

5. The motion sensor of claim **1**, wherein the base is adapted to be affixed at an interior corner of the vertical wall.

6. The motion sensor of claim **1**, the socket further comprising a concave rear-facing curved surface between the top wall and the bottom wall;

wherein the distal end of the stem is variably positionable in the socket to set the motion sensor body at a plurality of azimuth angles between a first azimuth angle and a second azimuth angle.

7. The motion sensor of claim **6**, comprising a first alignment mechanism to position the distal end of the stem at a first location in the socket to set the motion sensor body to the first azimuth angle of about 45 degrees;

a second alignment mechanism to position the distal end of the stem at a second location in the socket to set the motion sensor body to the second azimuth angle of about −45 degrees; and

a third alignment mechanism to position the distal end of the stem at a third location in the socket to set the motion sensor body to a third azimuth angle of about 0 degrees.

8. The motion sensor of claim **1**, wherein the first magnetic material comprises steel shaped to form the rear-facing surface of the socket, and the second magnetic material comprises a magnet.

9. A method of mounting a motion sensor comprising:

obtaining a motion sensor body comprising a socket and a detection pattern with a functionality plane bounding a top of the detection pattern, wherein the socket is recessed into a back side of the motion sensor body at a first angle from the functionality plane of the motion sensor body;

obtaining a mount comprising a base and a stem, the base adapted to be affixed to a vertical wall in either a first orientation or a second orientation, a proximal end of the stem attached to the base, and a distal end of the stem formed to fit into the socket, wherein the stem extends from the base at a second angle from horizontal;

selecting an orientation from the first orientation or the second orientation to use to affix the mount to the vertical wall based on a mounting height, a target coverage area, and the detection pattern of the motion sensor body;

affixing the mount on the vertical wall in the selected orientation at the mounting height;

inserting the stem into the socket with the motion sensor body in an upright position to situate the motion sensor body on the mount;

wherein the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle plus the second angle if the mount is affixed to the vertical wall in the first orientation; and

the functionality plane of the motion sensor body is set at an angle from horizontal equal to the first angle minus

the second angle if the mount is affixed to the vertical wall in the second orientation.

10. The method of claim **9**, further comprising:

determining an azimuth angle for the motion sensor body based on the target coverage area and the detection pattern of the motion sensor body;

positioning the end of the stem at an appropriate location in the socket to set the motion sensor body at the determined azimuth angle.

11. A security apparatus comprising:

a sensor body comprising a socket, wherein the socket is recessed into the sensor body at a first angle from a functionality plane of the sensor body, the socket comprising a first wall and a second wall opposite from the first wall; and

a mount comprising a base and a stem, the base adapted to be affixed at a mounting plane, a proximal end of the stem attached to the base, and a distal end of the stem formed to fit into the socket, wherein the stem extends from the base at a second angle from a normal vector that is perpendicular to the mounting plane and the stem comprises a first side and a second side opposite from the first side;

wherein the functionality plane of the sensor body is set at an angle from the normal vector equal to the first angle plus the second angle if the stem is inserted into the socket with the first side of the stem in close proximity to the first wall of the socket; and

the functionality plane of the sensor body is set at an angle from the normal vector equal to the first angle minus the second angle if the stem is inserted into the socket with the first side of the stem in close proximity to the second wall of the socket.

12. The security apparatus of claim **11**, further comprising:

a first marking on the mount positioned to be upright if the mount is affixed to a vertical surface in a first orientation with the first side of the stem facing up; and

a second marking on the mount positioned to be upright if the mount is affixed to the vertical surface in a second orientation with the second side of the stem facing up.

13. The security apparatus of claim **11**, wherein the base is adapted to be affixed at an interior corner of two surfaces intersecting in the mounting plane.

14. The security apparatus of claim **11**, wherein the sensor body is set to a substantially fixed position with respect to the mount when the stem is inserted into the socket.

15. The security apparatus of claim **11**, wherein the sensor body is pivotable on the stem in a plane parallel to the stem.

16. The security apparatus of claim **11**, wherein the first wall and the second wall of the socket are substantially flat, and the socket further comprises a curved rear-facing surface between the first wall and the second wall; and

the first side and second side of the stem are substantially flat and are formed to fit into the socket in close proximity to the first and second wall of the socket when the distal end of the stem is inserted into the socket;

wherein the distal end of the stem is positionable at a first location in the socket to set the sensor body at a first azimuth angle from the stem; and

the distal end of the stem is positionable at a second location in the socket to set the sensor body at a second azimuth angle from the stem.

17. The security apparatus of claim **16**, wherein the curved rear-facing surface of the socket is shaped as a section of a sphere with a given diameter, and the distal end of the stem is shaped as a section of a sphere with a diameter about the same as the given diameter.

18. The security apparatus of claim **16**, wherein the distal end of the stem is variably positionable in the socket to set the sensor body at a plurality of azimuth angles between the first azimuth angle and the second azimuth angle.

19. The security apparatus of claim **18**, wherein the first azimuth angle is equal to about 45 degrees to the right of the stem, and the second azimuth angle is equal to about 45 degrees to the left of the stem.

20. The security apparatus of claim **16**, wherein an alignment mechanism is used to position the distal end of the stem in the first location in the socket.

21. The security apparatus of claim **20**, wherein the alignment mechanism comprises a sub-socket or a detent in the rear-facing surface of the socket, a detent on the first or second wall of the socket, or a visible marking on the sensor body.

22. The security apparatus of claim **16**, further comprising:

a first magnet positioned near the distal end of the stem with a first magnetic pole facing the distal end of the stem;

a second magnet placed near the first location in the socket with a magnetic pole opposite of the first magnetic pole facing into the socket; and

a third magnet placed near the second location in the socket with a magnetic pole opposite of the first magnetic pole facing into the socket.

23. The security apparatus of claim **11**, wherein the socket comprises a first magnetic material, and the distal end of the stem comprises a second magnetic material, and the distal end of the stem is held in the socket by magnetic force.

24. The security apparatus of claim **23**, wherein the first magnetic material comprises steel, and the second magnetic material comprises a magnet.

25. The security apparatus of claim **24**, wherein the steel magnetic material snaps into a cavity on the back of the sensor body to form at least part of the socket.

26. The security apparatus of claim **23**, wherein the first magnetic material comprises one or more magnets placed near the socket with a magnetic pole facing into the socket, and the second magnetic material comprises a magnet with an opposite magnetic pole facing the distal end of the stem.

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